Exceptional service in the national interest

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Intermittent sources require storage

Wind/PV: ~ 30% of 43 GW new construction

Cheap, Abundant & Safe Materials

=

Advanced Zinc-Manganese Oxide Alkaline Batteries

September 2016

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U.S. DEPARTMENT OF ENERGY | NNSA National Nuclear Security Administration

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Grid Storage Requires Cheap, Reliable Storage

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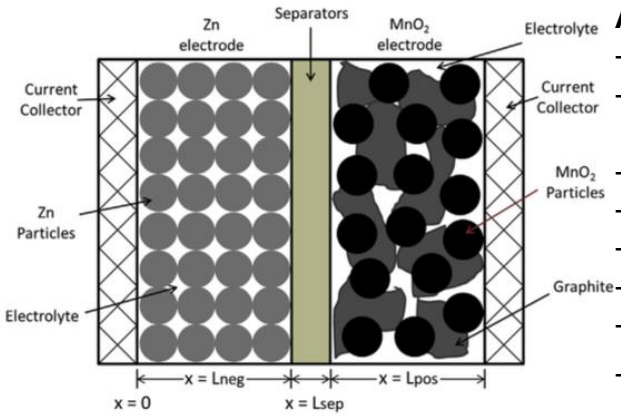


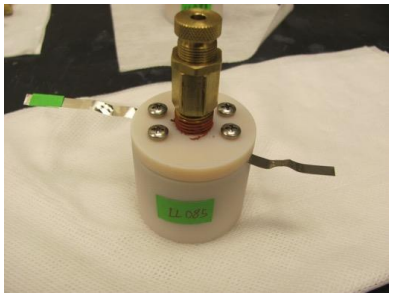
Alkaline Zn/MnO_2 Batteries:

- Traditional primary batteries @ $18 kWh
- Long shelf life, lowest cost of materials, lowest manufacturing expenses, established supply chain
- Can be scaled to large form factors
- Limited thermal management required compared to Pb or Li
- Safer, environmentally friendly (EPA certified for landfill disposal, non flammable)
- Limited Depth of Discharge = reversible 1 e^- process (CCNY/CUNY-EI)
- Current cost ~ < $100 KWh (Urban Electric Power, NY)
- Significant Opportunity to ⤴ capacity and ⤵ cost: 350 Wh/L @ < $50 KWh delivered?

Sandia is Building a Comprehensive Program

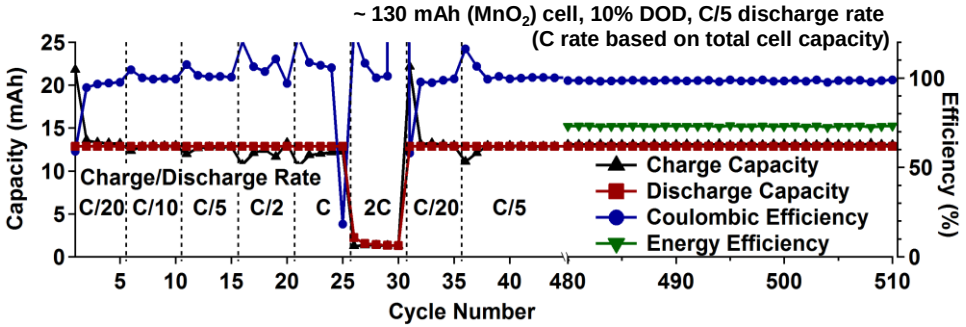
- $ FY16 Late start, OE - *Dr. Imre Gyuk, SNL Program Manager Dr. Babu Chalamala*
- SNL *(Dr. Lambert, Dr. Duay, Dr. Allcorn, Dr. Nagasubramanian, Ms. Kelly, Mr. Vigil)*
- FY 17, CCNY/CUNY-EI *(Prof. Banejee, Prof., Messinger, Dr. Galloway and team)*
- $, FY 17, *c*omplementary LDRD Funding
- NMSU *(Prof. Vasiliev – DFT Studies)*

SNL Zn/MnO_2 Battery



~ 1-500 mAh

Baseline performance is currently being established



Opportunity exists to increase capacity and lower cost

- Understand Battery Chemistry
- Improve Materials
- Demonstrate Performance